"AN OBSERVATIONAL CROSS-SECTIONAL STUDY TO ASSESS THE ASSOCIATION OF PATTERNS OF CHELIOSCOPY, RUGOSCOPY AND CANINE INDEX WITH GENDER AND BLOOD GROUPS"

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In partial fulfillment of the requirement for the degree of

MASTER OF DENTAL SURGERY

In the specialty of

ORAL AND MAXILLOFACIAL PATHOLOGY AND ORAL MICROBIOLOGY

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(Established u/s 3 of the UGC Act, 1956)

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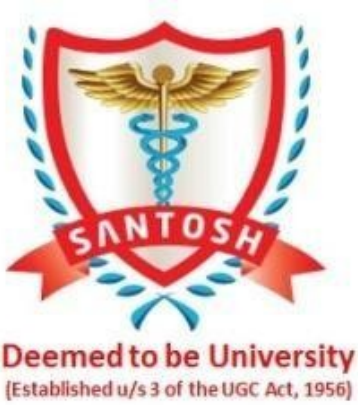

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Dr. Avneesh Kumar

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LIST OF ABBREVIATIONS

S.No.	ABBREVIATIONS	FULL FORM
1.	FO	Forensic Odontology
2.	LP	Lip Prints
3.	PR	Palatal Rugae
4.	MCI	Mandibular Canine Index
5.	BG’s	Blood Groups

Introduction

INTRODUCTION

Forensic odontology (FO) serves as a vital tool in establishing the identity of individuals, particularly in cases where conventional methods like fingerprint analysis or DNA profiling cannot be applied. In such circumstances, anatomical features that exhibit individuality, resistance to environmental conditions, and permanence gain prominence. Among these, lip prints (chelioscopy, LP), palatal rugae (rugoscopy ,PR), and the mandibular canine index (MCI) are increasingly recognized for their forensic utility. These morphological traits have been studied for their role in personal identification, with particular emphasis on sex determination and potential correlations with ABO blood groups (BG's).

This observational cross-sectional study aimed to assess the relationship between cheiloscopy, rugoscopy, and the mandibular canine index (MCI) in relation to gender and blood group (BG). By examining a diverse population, the study aimed to assess the forensic utility of these parameters and determine whether they can serve as reliable identifiers in medico-legal investigations.

Chelioscopy involves the analysis of LP patterns, which are considered to be unique and consistent throughout an individual's life, similar to fingerprints. The foundational work by Suzuki and Tsuchihashi in 1970 introduced the concept of LP as a means of personal identification and proposed a classification system for their patterns, which remains widely accepted today[1]. Subsequent studies have reported notable gender-based variations. For instance, Verghese et al. observed a higher prevalence of Type I and I′ patterns among females, whereas Type III and IV were more commonly found in males[2]. Sivapathasundaram et al. also reported population-level differences in LP patterns, supporting their use in forensic profiling[3].

Efforts have also been made to investigate the potential correlation between LP patterns and blood group types. Sharma et al. and Saraswathi et al. found some evidence suggesting associations between specific lip patterns and ABO BG's, though findings varied significantly

across populations [4,5]. The present study builds upon these findings, analyzing lip print patterns across genders and blood groups to explore their broader forensic relevance.

Palatal rugae are ridged structures present in the front part of the hard palate, are formed in utero and remain largely unchanged throughout life. Their protected anatomical location makes them resistant to trauma, decomposition, and fire, increasing their value in forensic investigations [6]. PR patterns are commonly classified as straight, curved, wavy, or circular[7]. Investigations done by Shetty et al. and Nayak et al. have identified existence of sexual dimorphism in rugae patterns, with certain configurations occurring more frequently in either males or females[8,9]. Additionally, rugoscopy has been employed to study ethnic and racial differences, with some populations exhibiting distinct rugae characteristics[10,11].

Some researchers have explored possible links between PR patterns and blood groups. Although limited studies, such as those by Paliwal et al., have suggested that certain rugae shapes may be more frequent in specific blood group categories, the current evidence is not conclusive[12]. The present study contributes to the ongoing exploration of these associations, while emphasizing the need for further large-scale investigations.

The MCI which involves the measurement of mandibular canine widths and inter-canine distance, is a well-established method for sex determination due to the observed sexual dimorphism in these measurements. Garn et al. were among the first to document that male mandibular canines are generally larger than those of females [13]. Rao et al. and Muller et al. have established the mandibular canine index (MCI) as a reliable marker using dental remains[14],[15]. Moreover, results of Ates et al. and Kaushal et al. further supported its accuracy and cost-effectiveness in forensic investigations, especially when only skeletal remains are available[16],[17].

Although a few studies, such as the one by Surekha et al., have attempted to investigate any possible association between MCI and blood group, the consensus remains that MCI is best suited for sex determination, with little evidence of a reliable link to blood type[18].

In forensic cases—particularly in mass disasters, homicides, or scenarios involving mutilated or decomposed bodies—traditional methods of identification may not be feasible. In such instances, alternative markers like lip prints, palatal rugae, and mandibular canine dimensions can serve as valuable forensic tools due to their durability and uniqueness. While each of these has individually been studied for personal identification and sex estimation[19], there is a paucity of research exploring their combined application. Integrating all three parameters could enhance accuracy in forensic evaluations, particularly when other identifiers are unavailable or compromised.

However, one must also consider that anatomical variations in lip prints, rugae patterns, and canine measurements may differ across populations due to genetic and environmental factors. This necessitates region-specific studies to validate the reliability of these traits. Moreover, inconsistencies in classification methods and measurement techniques across studies contribute to conflicting findings, highlighting the need for standardized methodologies to ensure consistency and reproducibility.

Therefore, This analysis was performed to explore theforensic relevance of cheiloscopy, rugoscopy, and the mandibular canine index, while also examining their potential correlation with different blood group types. The findings aim to contribute to the existing body of forensic literature and aid in developing more robust identification methods for use in FO.

Aims and Objectives

AIM AND OBJECTIVES

AIM:

To analyse patterns of chelioscopy, rugoscopy and canine index and their association with gender and type of blood group.

OBJECTIVES:

1. To analyse patterns of chelioscopy, rugoscopy and canine index in males and females
2. To analyse patterns of chelioscopy, rugoscopy and canine index in different types of blood groups
3. To assess the association of patterns of chelioscopy, rugoscopy and canine index with gender
4. To assess the association of patterns of chelioscopy, rugoscopy and canine index with different types of blood groups

Review Of Literature

REVIEW OF LITERATURE

1. **Verghese A, Somasekar M, Babu U (2010)[2]** analyzed lip print types among students belonging to various ethnic groups in Karnataka, India. The study aimed to understand whether genetic or environmental factors influenced lip print patterns and if any correlation existed between ethnicity and lip morphology. The researchers examined lip prints using a standardized classification method and found distinct variations among individuals of different ethnic backgrounds. Furthermore, they suggested that chelioscopy could be effectively used alongside other biometric techniques such as fingerprinting and DNA analysis for more accurate forensic identifications.
2. **Sivapathasundaram B, Prakash PA, Sivakumar G (2001)[3]** delved into the forensic application of lip prints and their reliability as a method of personal identification. Their study highlighted that lip patterns remain unchanged from birth until death, making them an effective biometric marker. They categorized lip print patterns into various types, such as vertical, intersected, and reticular, and proposed that these patterns could be documented and stored similarly to fingerprint databases. The research emphasized the need for standardizing lip print analysis in forensic casework, particularly in crime scene investigations where suspects or victims might have left lip impressions on surfaces such as glasses, paper, or skin.
3. **Rathod V, Sharma P, Saxena S, (2017)[4]** implemented an innovative research aimed to investigate whether a hereditary connection exists between these traits, with the goal of enhancing forensic identification in criminal investigations and cases involving missing individuals. The study revealed certain associations between specific lip print patterns and blood group types, suggesting that chelioscopy, when combined with serological markers, could strengthen forensic identification methods. The researchers recommended further large-scale studies to validate their findings and explore the genetic basis of lip print formations.

4. **Saraswathi TR, Mishra G, Ranganathan K (2009)**[5] focused on the classification of lip prints and their forensic relevance in human identification. Their study confirmed that each individual exhibits a distinct lip print pattern to individuals and do not undergo significant changes over time, reinforcing their reliability as a forensic tool. The researchers proposed a systematic classification of lip prints, emphasizing the need for forensic experts to develop standardized protocols for their collection and analysis. They also highlighted potential applications in criminal investigations, particularly in cases where other biometric identifiers, such as DNA or fingerprints, are unavailable or inconclusive.
5. **Acharya AB , Patil MS, Patil SB (2008)**[6] provides a comprehensive overview of the anatomical, developmental, and clinical importance of palatal rugae. The authors emphasized that these ridges develop during intrauterine life making them a reliable anatomical landmark. Clinically, palatal rugae have applications not only in forensic identification but also in prosthodontics, orthodontics, and restorative dentistry. The review discussed their utility as stable reference points in dental casts for post-treatment assessment and in denture fabrication for edentulous patients. Additionally, the paper highlighted their significance in forensic science due to their resistance to trauma, chemicals, and decomposition. The authors also suggested that while palatal rugae have shown potential in personal identification and population profiling, more research is needed to standardize classification systems and improve their forensic applicability.
6. **Shetty S, Premalatha K (2005)**[8] studied palatal rugae patterns among the Indian population to determine their uniqueness and applicability in forensic science. They concluded that rugae configurations remain unchanged throughout life, making them an ideal tool for forensic identification. The study suggested that palatoscopy could be particularly useful in cases of mass casualties, where conventional identification methods such as dental records or fingerprints might not be available. Their findings

also supported the idea that palatal rugae patterns could provide additional information in forensic anthropology, helping in distinguishing individuals from different geographic or ethnic backgrounds.

7. **Kaveri H, Nayak P, Padmini AT, Acharya AB (2007)[9]** explored the variations in palatal rugae shapes between distinct Indian communities. Their objective was to analyze whether rugae patterns could serve as an indicator of genetic and ethnic differences. The study revealed that individuals from different regions exhibited unique rugae configurations, reinforcing the idea that palatoscopy could be used for population differentiation. Moreover, their findings particularly in cases where DNA analysis is impractical. The study emphasized the need for creating regional databases of palatal rugae patterns to enhance their forensic utility.
8. **Paliwal A, Wanjari S(2010)**[12] examined the role of palatal rugoscopy in sex determination. Their study analyzed palatal rugae patterns assessing whether any consistent differences could be used to determine sex. The results indicated that certain rugae patterns were more prevalent in males than in females, making rugoscopy a potentially useful tool in forensic sex determination. The researchers suggested that when used alongside other odontometric and skeletal indicators, palatal rugae analysis could significantly improve accuracy in forensic identification.

9. **Muller M, Liversidge HM. (2019)[15]** examined the challenges and limitations of age estimation using dental evidence**,** especially in forensic settings. While teeth are commonly used for age estimation due to their resistance to decomposition and wear, the study pointed out significant variability in dental development across populations and individuals, which complicates the process. The authors emphasized that despite advancements in imaging and analysis techniques, accurately estimating age based

solely on dental features remains uncertain, particularly in late adolescence and adulthood. This paper called for more standardized, population-specific studies to enhance the reliability of dental age estimation in forensics.

10. **Ates M, Karaman F, Yavuz MS. (2006)[16]** investigated sexual dimorphism in the Turkish population by analyzing dental measurements, with a focus on mandibular canines. The authors emphasized the importance of using population-specific data in forensic studies, as odontometric differences can vary across ethnic groups. Their findings support the use of mandibular canines as a dependable and non-invasive method for sex estimation in forensic cases.
11. **Agnihotri G, Kaushal S, Patnaik VV(2003)[17]** conducted a research which confirmed significant sexual dimorphism in mandibular canine dimensions, supporting its use as an auxiliary forensic tool in human identification. They proposed that odontometric analysis, when used alongside other forensic techniques, could enhance the accuracy of sex determination, especially in cases where DNA analysis is not feasible.
12. **Surekha R et al. (2012)[18]**examined whether a correlation exists between ABO blood groups, Rh factor, and the Mandibular Canine Index (MCI). While the MCI showed clear sexual dimorphism, the results showed no significant association between MCI and blood group or Rh status. The authors concluded that although MCI is a reliable indicator for sex determination, it cannot be used to predict blood group characteristics.
13. **Acharya AB, Mainali S (2009)[19]** examined to assess whether population-specific variations existed in canine dimensions and if they could be reliably used in forensic investigations. Their results confirmed that the MCI was an effective parameter for sex differentiation, with a high degree of accuracy. The researchers advocated for further studies to develop population-specific odontometric standards, improving forensic applicability worldwide.

14. **Zalawadia AZ, Patel SM, Parekh DH, Patel SV(2012)[20]** found that males consistently had larger canine teeth than females, confirming that odontometric analysis could serve as a reliable method for sex determination in forensic cases. The study also emphasized the importance of considering regional and ethnic differences when applying odontometric parameters in forensic investigations.
15. **Rao NG, Nagesh KS, Ahmed Mujib BR, Naidu E (2013)[21]** conducted a study which confirmed that palatal rugae exhibit stability over time and remain unique to individuals, making them an effective forensic marker. The researchers advocated for incorporating palatal rugae analysis into routine forensic casework, especially in situations where other biometric identifiers are unavailable. Their findings supported the forensic significance of rugoscopy in criminal investigations and disaster victim identification.
16. **Manjula WS, Sreelakshmi N, Harish P (2017)[22]** explored the correlation between the canine index and blood groups for forensic sex determination. Their study aimed to determine whether a person's blood group could influence their canine dimensions and contribute to forensic identification. The results indicated that while the canine index remained a reliable parameter for sex determination, no significant correlation was observed between blood groups and odontometric traits. The study concluded that combining odontometric analysis with other forensic techniques could enhance the accuracy of human identification.
17. **Nagalaxmi V, Ugrappa S, Chandrasekharan R, Reddy VS, Ramesh T, Reddy S (2014)[23]** conducted a comparative study on chelioscopy, palatoscopy, and odontometrics for sex prediction and discrimination. Their research aimed to evaluate the reliability of these three techniques in forensic identification. The study found that each method had its own strengths, with palatal rugae analysis being particularly useful in cases where skeletal remains were available, while lip prints and mandibular canine

measurements were effective in soft tissue identification. The researchers recommended an integrated approach, using all three techniques simultaneously, to improve forensic accuracy.

18. **Kumawat et al. (2017)[24]** investigated the utility of (MCI). Their findings reinforced presence of significant sexual dimorphism, with male mandibular canines consistently exhibiting larger dimensions compared to those of females. The study highlighted the reliability of MCI as a practical and non-invasive method, particularly valuable in forensic scenarios where conventional identifiers such as DNA profiling or fingerprint analysis are either compromised or unavailable.
19. **Forrest AS (2023)[25]** provided an overview of forensic odontology in the Encyclopedia of Forensic Sciences*,* discussing various techniques used for human identification. The study covered a broad range of forensic applications, including chelioscopy, palatoscopy, and odontometry. It highlighted advancements in forensic dentistry, including digital imaging techniques and artificial intelligence applications in forensic identification. The research reinforced the importance of integrating traditional forensic odontology with modern technological advancements to enhance accuracy in human identification.
20. **Badole SM, Wasekar RR, Kulkarni SP et al. (2016)[26]** did a comparative research where findings indicated that while each method had a high degree of accuracy, combining all three significantly improved forensic precision. They recommended that forensic odontologists develop standardized protocols to integrate these techniques into routine forensic investigations.
21. **Gardezi S, Hassan N, Memon S (2018)[27]** examined the effectiveness of the canine index where they found significant sexual dimorphism in canine dimensions, making the mandibular canine index a valuable forensic tool. They also suggested that regional

variations should be considered when applying odontometric parameters for forensic identification.

22. **Maloth KN, Kodangal S ,V N, Ugrappa S, M NJ(2015)[28]** used an integrated approach involving cheiloscopy, palatoscopy, and odontometrics was explored for predicting and distinguishing sex. Their research confirmed that integrating multiple forensic identification techniques enhances accuracy and reliability in forensic casework. They advocated for the adoption of a multidisciplinary approach in forensic investigations, particularly in cases where other forms of biometric evidence are unavailable.
23. **Negi et al. (2023)[29]** conducted a comprehensive study to evaluate the roles of cheiloscopy, pulp tissue analysis, and fingerprint patterns in gender determination. Their findings indicated that among the three, cheiloscopy played a notable role in establishing gender identity due to its distinct patterns. The research emphasized importance of lip print analysis as a non-invasive and cost-effective tool in forensic identification. They classified lip prints using Tsuchihashi's classification and correlated the most common patterns observed with gender. The study supports the inclusion of cheiloscopy in multidisciplinary forensic protocols.
24. **Barasabha et al. (2024)[30]** explored the utility of 3D printing technology in forensic odontology by creating a customized oral mannequin using palatal rugae patterns. This novel approach was aimed at improving forensic education and simulation accuracy. The rugae patterns were digitally captured and replicated using 3D printing, allowing for repeatable and lifelike educational models. This innovation is pivotal in teaching future forensic odontologists how to identify individuals using palatal rugae, which are unique and relatively resistant to trauma.
25. **Kumar et al. (2024)[31]** presented a systematic review analyzing the use of intraoral scanning and palatal morphology for human identification. The review included multiple studies that demonstrated the effectiveness of digital scanning in accurately

capturing rugae patterns. They concluded that digital tools provide a non-invasive, reproducible, and reliable alternative to traditional plaster casts for forensic purposes. Moreover, the digital format allows easier storage and comparison in forensic databases.

26. **Trizzino et al. (2023)[32]** performed a retrospective observational study aimed at assessing the applicability of palatal rugae patterns in determining sex. By analyzing a substantial sample of maxillary impressions, the study identified morphological differences in rugae patterns. These findings support the premise that, in addition to their role in individual identification, palatal rugae may also exhibit sex-related characteristics, thereby serving as a supplementary tool in forensic investigations.
27. **Vitai et al. (2024)[33]** utilized machine learning algorithms on digital palatal scans to test their accuracy in human identification. This pilot study showed promising results, with high levels of sensitivity and specificity. The researchers found that AI models trained on rugae morphology could reliably differentiate individuals, thereby opening new avenues for biometric-based forensic systems. Their findings underscore the potential for integrating AI into routine forensic protocols involving oral features.
28. **Özeren Keşkek et al. (2024)[34]** explored the use of volumetric analysis of maxillary canines via Cone-Beam Computed Tomography (CBCT) for sex determination. The study measured canine volume in males and females and found significant differences, reinforcing the idea that maxillary canines are sexually dimorphic. This technique provides a highly accurate method for forensic odontological analysis, especially in cases where other skeletal remains are unavailable.
29. **Saini (2023)[35]** reviewed multiple forensic cases where MCI was employed successfully. It emphasized that mandibular canines exhibit greater sexual dimorphism compared to other teeth, making them ideal candidates for forensic analysis. The study

proposed standard reference ranges for MCI based on regional population data, enhancing its applicability in real-world scenarios.

30. **Ali et al. (2024)[36]** introduced an explainable machine learning model that integrates dental biometrics to estimate age and gender. The model was trained on datasets consisting of dental X-rays and biometric data, offering not only accurate predictions but also interpretable outputs that can be validated by forensic experts. The study demonstrated that AI could streamline the forensic identification process, especially in mass disaster scenarios or unidentified cadaver cases.

Materials and Methods

MATERIALS AND METHOD

Study Settings

The research was undertaken at Santosh Dental College & Hospitals, located in Ghaziabad, Delhi (NCR), India. This institution is well-equipped with state-of-the-art facilities for dental research, and it provided an ideal environment for carrying out this study.

Study Design

This was a cross-sectional observational study. The primary aim was to assess various biometric traits, such as canine index, palatal rugae patterns (rugoscopy), lip print patterns (chelioscopy), and blood group for the purpose of personal identification. The cross-sectional design allowed for the analysis of these traits at a single point in time.

Ethical Considerations

This research was undertaken in full compliance with the ethical standards of Santosh Dental College & Hospitals. Before inclusion in the study, each participant received comprehensive information regarding the objectives, methodology, and any foreseeable risks, and their voluntary informed consent was duly obtained. Written informed consent was obtained from each individual, affirming their voluntary participation. Participant confidentiality and privacy were rigorously maintained, with all data anonymized and handled securely to ensure ethical compliance.

Sample Size Calculation

Sample size

Software used: G power Version 3.1.9.6 Programme written by Franz Faul University Kiel

Sample size was determined by the formula based on the study population

The estimated sample size n is calculated as the solution of:

$$n = \frac{n'}{4}\left(1 + \sqrt{1 + \frac{4}{n'|P_2 - P_1|}}\right)^2$$

Where,

Power of study= 95%

Effect size p= 0.3

e= permissible error in estimation of incidence 5%

n= sample size

n' is sample size without continuity correction

- n **is sample size with the correction**
- P1, P2, are proportions in each group
- Q1=1−P1

Based on this, the required sample size was determined to be **220 participants**, which was divided into two equal groups:

- **Group 1 (Males):** 110 participants

- **Group 2 (Females):** 110 participants

The sample size was deemed sufficient to represent the target population and to ensure the validity of the results.

Inclusion Criteria

The participants were recruited according to the study's inclusion standards:

- **Age Range:** Individuals aged 18 - 70 years were enrolled in the study to represent a wide adult age range.
- **Dental Health:** The study only included individuals with no past significant dental history, ensuring that participants did not have any major dental issues that could interfere with the study's objectives.
- **Normal Molar and Canine Relationship:** Participants with normal molar and canine relationships were included, meaning there were no significant malocclusions or misalignments of the teeth.
- **No Caries:** Only individuals who had no caries or other major dental pathologies.

Exclusion Criteria

Participants were excluded from the study if they met any of the following criteria:

- **Developmental Anomalies:** Individuals having congenital dental anomalies/ malformations were excluded as these could affect the results of biometric measurements.

- **Surgical or Traumatic History:** Those with a history of oral or facial surgeries or trauma were excluded due to the potential impact on the anatomical features of the oral cavity.

- **Orthodontic Treatment or Orthognathic Surgery:** Participants who had undergone orthodontic treatment or orthognathic surgeries were excluded because these treatments might alter the shape or structure of the dental arches.
- **Malocclusions and Dental Changes:** Individuals with malocclusions/attrition of teeth were excluded to ensure that the study data represented individuals with healthy, normal dentition.

Materials Used

1. **Alginate Impression Material:** Tropicalgin by Zhermack, used for making dental impressions.
2. **Type III Dental Stone:** Kalstone by Kalabhai, used for pouring the dental impressions to create accurate dental casts.
3. **Black Pen Permanent Marker:** Used for marking key points during measurements.
4. **Magnification Glass:** Used for enhanced visualization during rugae and lip print analysis.
5. **Brass Wire:** Used for measuring the intercanine distance.
6. **Digital Vernier Calipers:** Used for precise measurement of canine width, intercanine distance, and rugae length. (Figure 1)
7. **Dark Coloured, Non-Glossy, Non-Metallic Lipsticks:** Used for creating the lip prints.
8. **White Paper (A4 Size):** Used for recording lip prints and other data.
9. **Transparent Cellulose Tape:** Used to transfer the lip print onto the paper.
10. **Tissue Papers:** Used for cleaning and preparation.

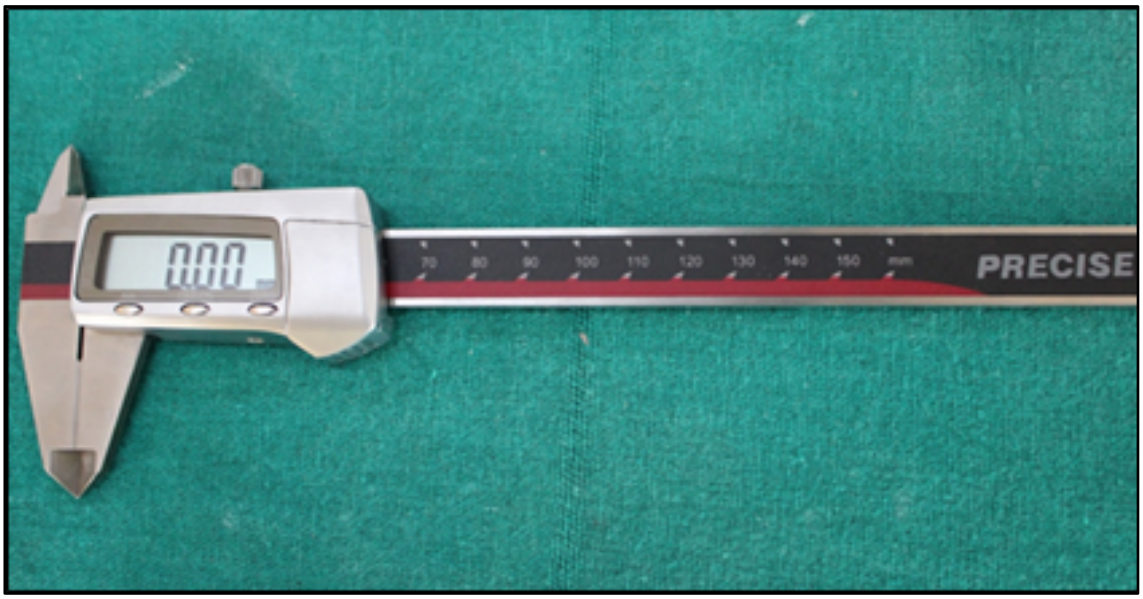


Figure 1: Vernier Callipers

Methodology

The study followed a structured and standardized methodology for each of the biometric analysis techniques:

Impression Taking

- **Procedure: Alginate** was used as the impression material to capture detailed imprints of the maxillary and mandibular dental arches. Perforated metal trays of appropriate size for each individual were used. Following impression making, dental stone was used to pour the impressions, resulting in the fabrication of solid dental casts. These casts served as the basis for various measurements and analyses, such as canine index and intercanine distance.

Canine Index Calculation

- **Measurement of Canine Width:** The greatest mesiodistal width of the mandibular canines was measured on the dental casts by determining the distance between the most prominent mesial and distal contact points of both right and left canines.(Figure 2)

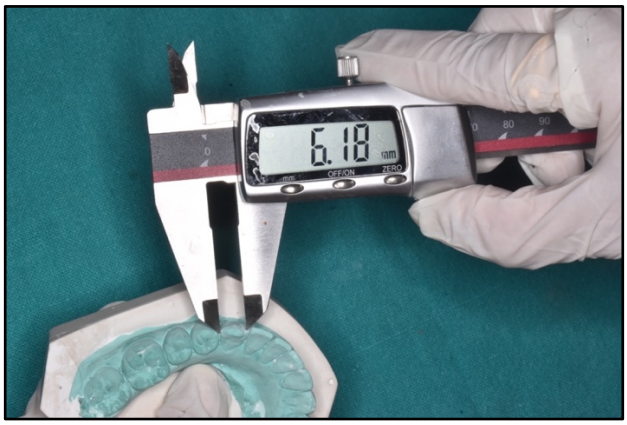


Figure 2: Measurement of Mandibular Canine Width

- **Intercanine Distance:** The linear distance between the cusp tips of the right and left mandibular canines was measured on the dental casts.(Figure 3)

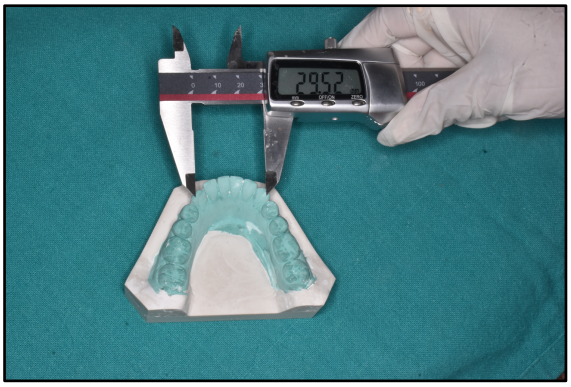


Figure 3: Measurement of Intercanine Distance

- **Canine Index Calculation:** The MCI for both the right and left sides was calculated by deriving the ratio of the mesiodistal width of the canine to the corresponding intercanine distance, using following formula:

$$\text{Canine Index} = \frac{\text{Mandibular canine arch width}}{\text{Mesiodistal crown width of mandibular canine}}$$

Rugoscopy (Palatal Rugae Analysis)

- **Rugae Classification:** The patterns of the palatal rugae (the folds on the roof of the mouth) were analyzed using the system proposed by Kapali et al. (1987).(Figure 4)

Figure 4: Analysis of Rugae Patterns

Chelioscopy (Lip Print Analysis)

- **Lip Print Collection:** A thin layer of dark-colored, non-glossy lipcolor was applied to the vermilion border of the lips and left for 3 minutes. A strip of transparent cellulose tape was then gently pressed across the lips from right to left. The tape was carefully removed, and the lip print was transferred onto a sheet of A4 white paper. (Figure 5 & 6)

Figure 5: Lip Print Collection

Figure 6: Transfer of Lip Print for Analysis

- **Classification of Lip Print Patterns:** The recorded lip prints were differentiated according to the pattern system developed by Tsuchihashi Y (1974). The lip print patterns were analyzed to check for any distinct features or correlations across the sample population.

Blood Group Recording

- **Blood Group:** The blood group of each participant was recorded based on the medical records available, as part of the demographic data collection. This was included to assess any potential correlations between blood group and biometric features like canine index, rugae patterns, or lip prints.

STATISTICAL ANALYSIS

The collected data were initially entered into Microsoft Excel 2010 and then transferred to IBM SPSS Statistics software version 27.0 for analysis. To verify the distribution pattern of the dataset, the Kolmogorov–Smirnov test was used to assess normality.

For comparison between groups involving qualitative variables, the Chi-square test was performed. It is particularly effective in examining relationships in contingency tables. In this study, a significance threshold is of 5% ($p < 0.05$).

The Chi-square test helps in determining if any observed difference between groups is likely due to chance or indicates a meaningful association, providing insight into variable interactions under the null hypothesis of independence.

In general, the *chi- square test statistic* is of the form

$$X^2 = \sum \frac{(\text{observed - expected})^2}{\text{expected}}$$

Results & Observations

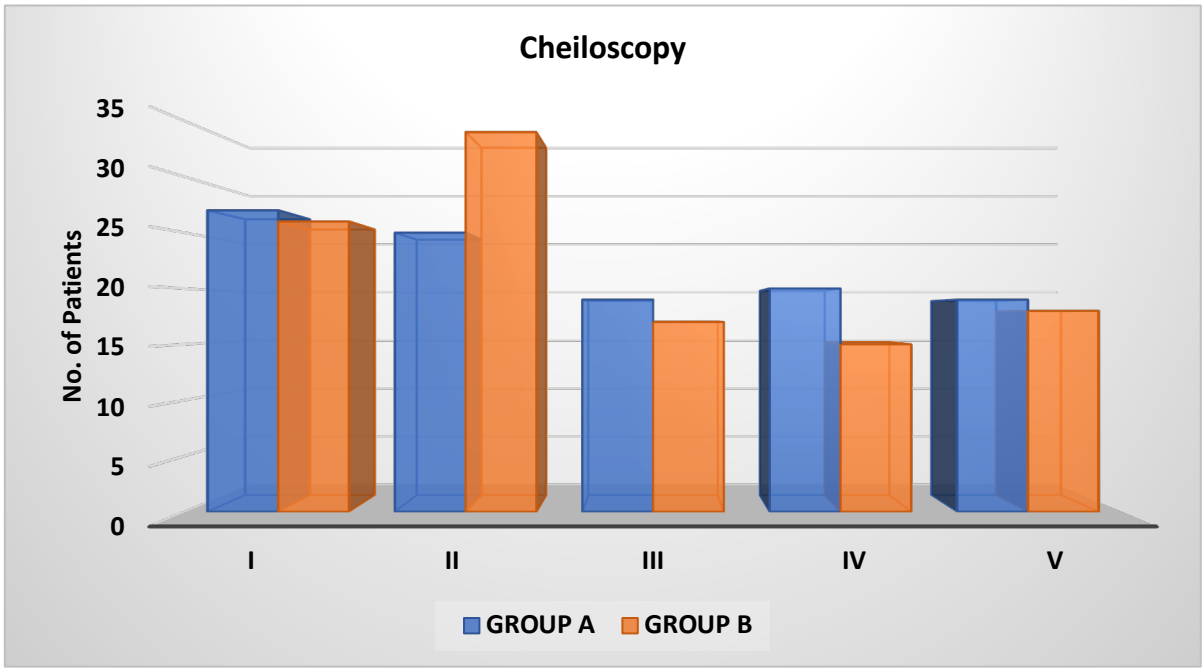
RESULTS & OBSERVATIONS

Table 1: Comparison and Evaluation of patterns of chelioscopy in males and females

(Ch-square test)

Cheiloscopy	GROUP A	GROUP B	Chi-Square value	p-value, S/NS
I	27 (12.3%)	26 (11.8%)	2.244	0.691,NS
II	25 (11.4%)	34 (15.5%)		
III	19 (18.6%)	17 (7.7%)		
IV	20 (9.1%)	15 (6.8%)		
V	19 (18.6%)	18 (8.2%)		

$p \leq 0.05$ – Significant, CI = 95 %



Graph 1: Comparison and Evaluation of patterns of chelioscopy in males and females

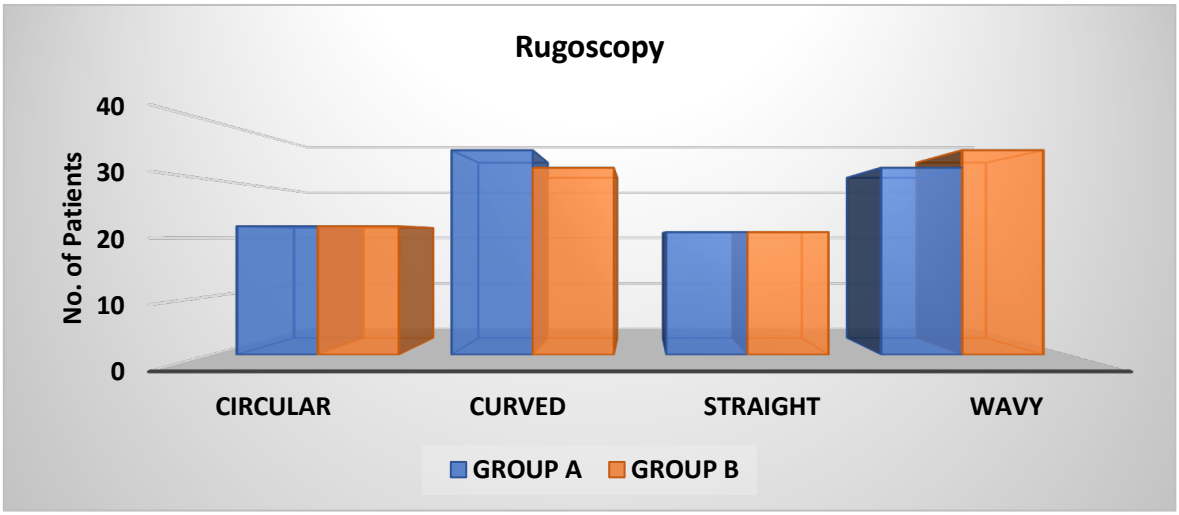
(Ch-square test)

In **Table 1 & Graph 1**, the **chi-square value** (2.244) and **p-value** (0.691) are consistent for all five cheiloscopy patterns (I to V), indicating that the observed differences between **Group A (Males)** and **Group B (Females)** are not statistically significant (**NS**). The p-value of 0.691, which is greater than 0.05, shows that the difference between the two groups is not significant, suggesting that gender does not have a meaningful influence on the distribution of cheiloscopy patterns.

Table 2: Comparison and Evaluation of patterns of rugoscopy in males and females (Ch-square test)

Rugoscopy	GROUP A	GROUP B	Chi-Square value	p-value, S/NS
Circular	22 (10%)	22 (10%)	0.269	0.966,NS
Curved	35 (15.9%)	32 (14.5%)		
Straight	21 (9.5%)	21 (9.5%)		
Wavy	32 (14.5%)	35 (15.9%)		

$p \leq 0.05$ – Significant, CI = 95 %



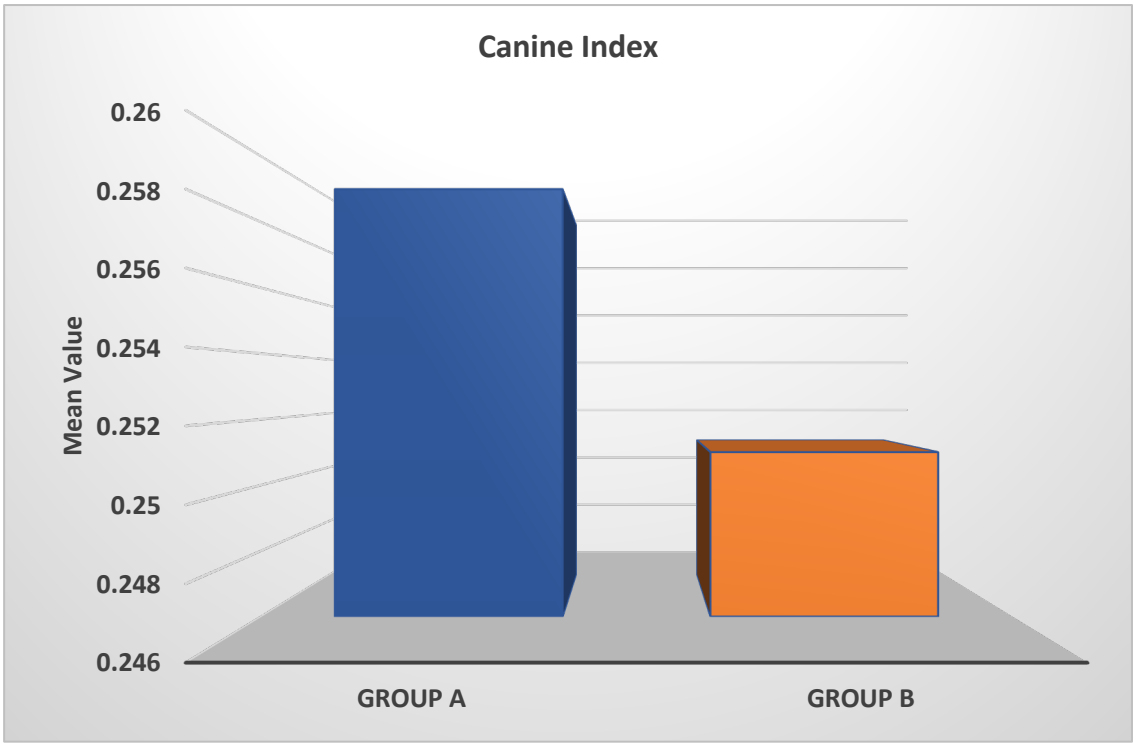
Graph 2: Comparison and Evaluation of patterns of rugoscopy in males and females (Ch-square test)

In **Table 2 & Graph 2**, the **chi-square value** (0.269) and **p-value** (0.966) indicates that there are no statistically significant differences between **Group A (Males)** and **Group B (Females)** across all patterns. The p-value of 0.966 is much higher than the 0.05 threshold, which confirms that the differences between the two groups are **not significant (NS)**, meaning gender does not seem to affect the distribution of rugoscopy patterns in this study.

Table 3: Comparison and Evaluation of canine index in males and females

Parameters	GROUPS	Mean	Std. Deviation	Chi-Square value	p-value, S/NS
Canine Index	**GROUP A**	0.259	0.021	7.819	**0.005,S**
	GROUP B	0.251	0.027		

p ≤ 0.05 – Significant, CI = 95 %



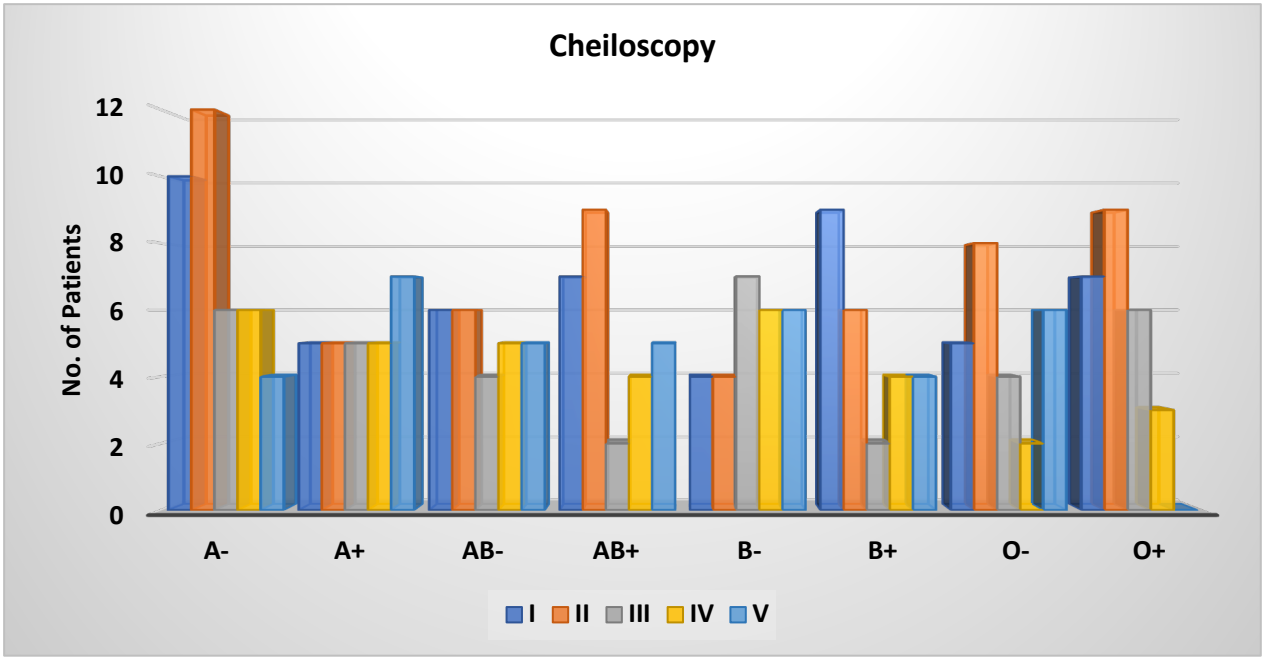
Graph 3: Comparison and Evaluation of canine index in males and females

For the **Canine Index**, **Group A (Males)** has a mean of 0.259 with a SD of 0.021, while **Group B (Females)** has a mean of 0.251 with a SD of 0.027. The **Chi-Square value** is 7.819, and the **p-value** is 0.005, which is less than 0.05, indicating that the difference between the two groups is **statistically significant (S)**. (**Table 3 & Graph 3)**

Table 4: Comparison and evaluation of patterns of chelioscopy in different types of blood groups (Ch-square test)

Chelioscopy	**A-**	**A+**	**AB-**	**AB+**	**B-**	**B+**	**O-**	**O+**	**p-value**
I	10 (4.5%)	5 (2.3%)	6 (2.7%)	7 (3.2%)	4 (1.8%)	9 (4.1%)	5 (2.3%)	7 (3.2%)	
II	12 (5.5%)	5 (2.3%)	6 (2.7%)	9 (4.1%)	4 (1.8%)	6 (2.7%)	8 (3.6%)	9 (4.1%)	
III	6(2.7%)	5 (2.3%)	4 (1.8%)	2 (0.9%)	7 (3.2%)	2 (0.9%)	4 (1.8%)	6 (2.7%)	**0.767**
IV	6(2.7%)	5 (2.3%)	5 (2.3%)	4 (1.8%)	6(2.7%)	4 (1.8%)	2 (0.9%)	3 (1.4%)	
V	4 (1.8%)	7 (3.2%)	5 (2.3%)	5 (2.3%)	6(2.7%)	4 (1.8%)	6(2.7%)	0(0%)	

$p \leq 0.05$ – Significant, CI = 95 %



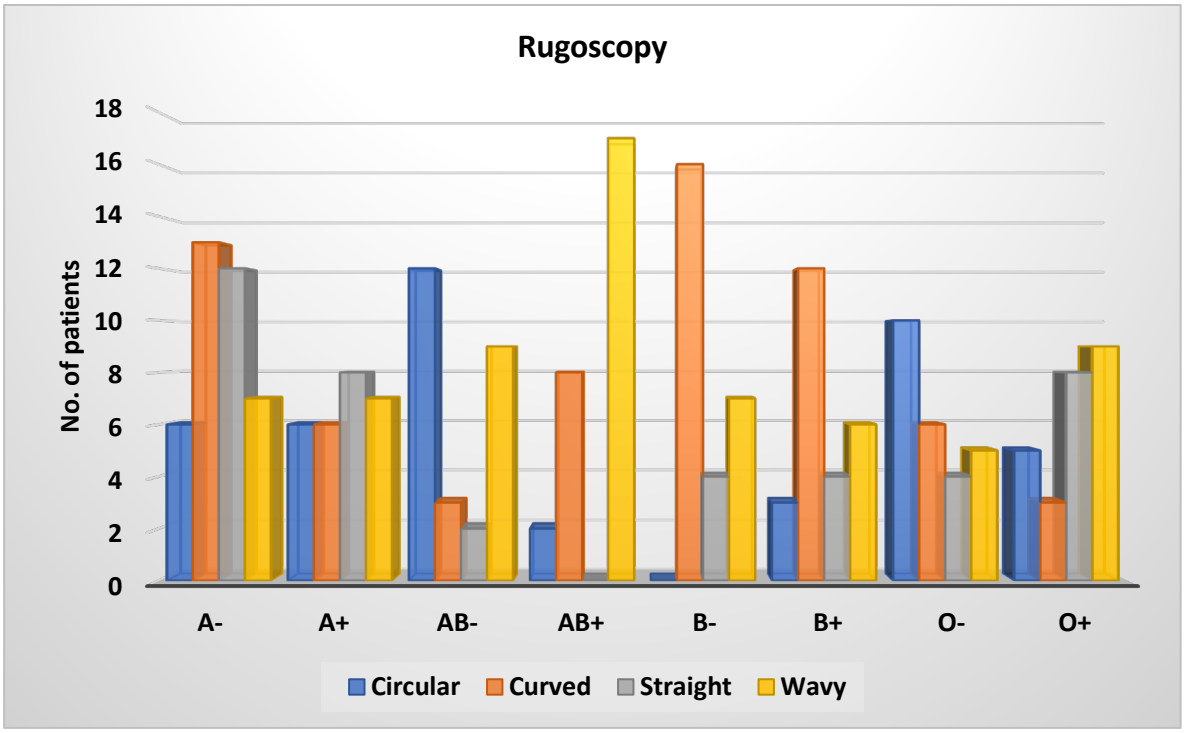
Graph 4: Comparison and evaluation of patterns of chelioscopy in different types of blood groups (Ch-square test)

Cheiloscopy Patterns (I-V): These represent different types of lip print patterns observed across the individuals in different blood groups.The **data** shows the number and percentage of individuals in each blood group (A-, A+, AB-, AB+, B-, B+, O-, O+) for each cheiloscopy pattern. The **p-value** for the comparison across all patterns is **0.767**, which is **greater than 0.05**, indicating that there is no statistically significant difference in distribution of cheiloscopy patterns across blood groups. Hence, the result is labeled as **NS (Not Significant)**. (**Table 4 & Graph 4)**

Table 5: Comparison and evaluation of patterns of rugoscopy in different types of blood groups (Ch-square test)

Rugoscopy	A-	A+	AB-	AB+	B-	B+	O-	O+	p-value
Circular	6(2.7%)	6(2.7%)	12(5.5%)	2(0.9%)	0 (0%)	3 (1.4%)	10 (4.5%)	5(2.3%)	
Curved	13(5.9%)	6(2.7%)	3(1.4%)	8(3.6%)	16 (7.3%)	12 (5.5%)	6(2.7%)	3(1.4%)	
Straight	12(5.5%)	8(3.6%)	2(0.9%)	0 (0%)	4 (1.8%)	4 (1.8%)	4(1.8%)	8(3.6%)	**<0.001, HS**
Wavy	7(3.2%)	7(3.2%)	9(4.1%)	17(7.7%)	7 (3.2%)	6 (2.7%)	5(2.3%)	9(4.1%)	

p ≤ 0.05 – Significant, CI = 95 %



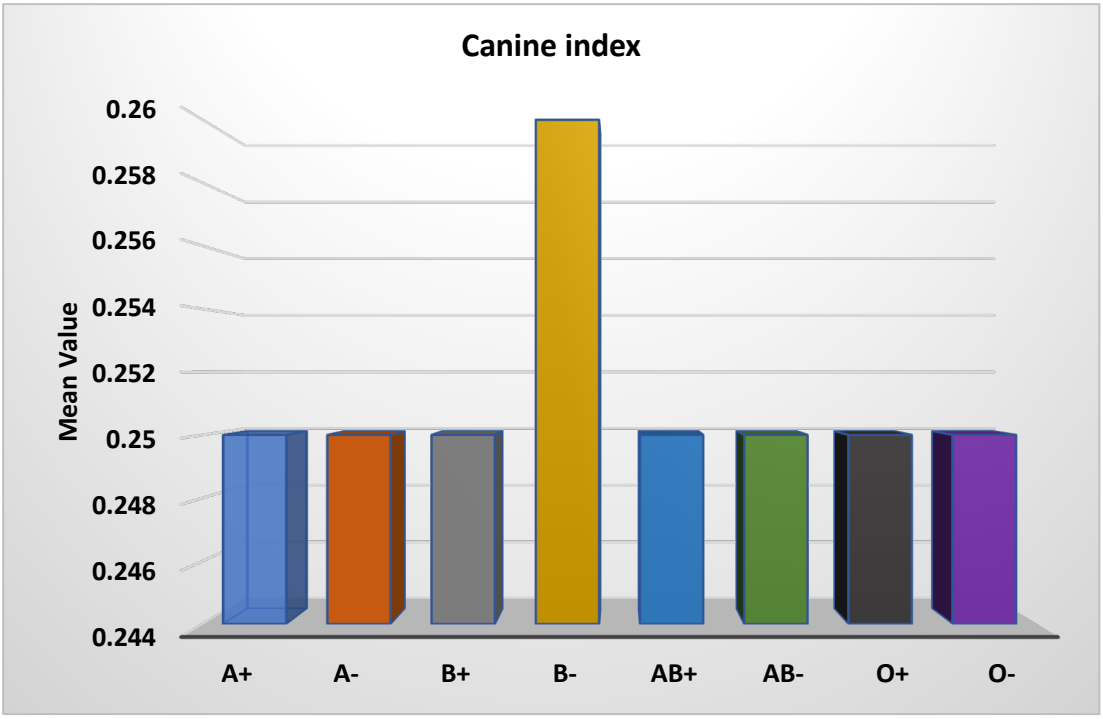
Graph 5: Comparison and evaluation of patterns of rugoscopy in different types of blood groups (Ch-square test)

Rugoscopy Patterns (Circular, Curved, Straight, Wavy): These represent different types of ridge patterns observed in the palatal rugae of individuals. The table shows the distribution of individuals exhibiting each pattern, broken down by their blood group. The **p-value is (<0.001>** for all four rugoscopy patterns (Circular, Curved, Straight, and Wavy), indicating that there is a highly significant statistical association between blood group and the distribution of all these patterns. This means that the type of blood group does influence the distribution of these specific rugoscopy patterns in this study. The analysis shows that blood group has a significant impact on the distribution of all four rugoscopy patterns (Circular, Curved, Straight, and Wavy). Therefore, we can conclude that the likelihood of exhibiting a specific rugoscopy pattern is significantly related to the individual's blood group. (**Table 5 & Graph 5)**

Table 6: Comparison and evaluation of canine index in different types of blood groups

Blood groups	**Mean**	**SD**	**Chi-square value**	**p-value, S/NS**
A+	0.25	0.020	6.228	0.513,NS
A-	0.25	0.025		
B+	0.25	0.024		
B-	0.26	0.026		
AB+	0.25	0.022		
AB-	0.25	0.025		
O+	0.25	0.021		
O-	0.25	0.029		

p ≤ 0.05 – Significant, CI = 95 %



Graph 6: Comparison and evaluation of canine index in different types of blood groups

The **mean** and **standard deviation (SD)** values for each blood group are given. Since the **p-value is greater than 0.05**, the result is labelled as **NS (Not Significant)**, indicating that blood group does not have a statistically significant effect on this particular parameter in this analysis. Since the **p-value** is greater than 0.05, we can conclude that there is **no significant difference** between the blood groups with respect to the parameter being analysed. The result is marked as **Not Significant (NS)** for all blood groups. (**Table 6 & Graph 6)**

Discussion

DISCUSSION

Forensic odontology has emerged as a critical field in personal identification, particularly when conventional methods are unavailable. Among the various modalities used for identification, cheiloscopy , rugoscopy and canine index (comparison of canine dimensions) hold significant promise due to their relative stability, resistance to external alterations, and potential for individualization. The present research was designed to review the forensic significance of these parameters and their correlation with gender and ABO blood group, thereby contributing to a more nuanced understanding of their applicability in medico-legal contexts.

The present investigation revealed that lip print patterns were comparable between male and female groups, suggesting a limited role for cheiloscopy in sex determination. This corresponds to the results reported by Vahanwala et al.[37], who emphasized the uniqueness of lip prints for individual identification but found no substantial gender predilection. Similarly, Saraswathi et al.[5] reported overlapping patterns among sexes, making it unreliable for definitive gender differentiation. Although some studies have proposed that vertical lip patterns are more common in females while branched or intersected types dominate in males, the statistical consistency of these trends remains elusive. The lack of sex-specific variation can be attributed to the embryological origin of lip prints, which are formed in intrauterine life and remain unchanged thereafter, irrespective of hormonal influences.

Likewise, palatal rugae patterns in this study demonstrated no significant association with gender, reaffirming the results of Kapali et al.[10] and Shetty and Premalatha[8], who concluded that rugae configurations are genetically controlled and minimally influenced by environmental or sex-specific factors. The stability and uniqueness of rugae patterns lend themselves well to personal identification, especially in cases involving burned or decomposed bodies. However, as observed here and in other literature, their utility in gender determination is debatable. The consistency of patterns across both sexes in our sample further supports the

theory that rugae morphology is not modulated by androgenic or estrogenic hormones post-development.

Contrastingly, the canine index in this study emerged as a reliable indicator of sexual dimorphism, exhibiting statistically significant variation between males and females. This finding is consistent with the works of Rao et al.[14] and Muller et al.[15], who demonstrated that males tend to exhibit greater mesiodistal widths of canines, likely due to hormonal effects during puberty that influence craniofacial and dental development. From an evolutionary standpoint, the pronounced size of canines in males has been attributed to sexual selection and defensive functions, although this has diminished over time. Nonetheless, the durability and distinctiveness of canine measurements support their integration into forensic protocols for sex estimation, particularly when skeletal remains are fragmented or incomplete.

Regarding the association between ABO blood groups and the three parameters under study, diverse outcomes were noted. While no significant relationship was found between lip print patterns and blood group, this is not unprecedented. Studies by Patil and Kodaguli [38] and Maheswari and Gnanasundaram [39] also found no definitive link, emphasizing the independent genetic pathways that govern blood group antigens and dermatoglyphic formations like lip prints. However, a few isolated investigations have suggested weak associations between blood group B and certain lip patterns, although these findings have lacked reproducibility and geographical consistency.

Interestingly, a significant correlation was observed between blood group and palatal rugae patterns, echoing the results of studies by Nayak et al.[9] and Deepa et al.[40], who hypothesized that common gene clusters may influence both craniofacial development and antigen expression. In our study, individuals with blood group B showed a higher prevalence of curved and wavy rugae patterns. While the precise biological basis remains unclear, it is plausible that genetic pleiotropy or linked loci on chromosomes involved in both traits contribute to this

phenomenon. This finding opens new avenues for interdisciplinary research involving genetics, craniofacial biology, and forensic anthropology.

On the other hand, the canine index did not demonstrate a significant association with ABO blood group, reinforcing conclusions drawn by authors like Rai and Anand [41], who observed that dental traits are predominantly polygenic and influenced by nutritional, developmental, and environmental factors rather than single-gene traits like blood group. Given the multifactorial nature of tooth size and morphology, it is unlikely that blood group antigens play a meaningful role in modulating canine dimensions.

While the findings of this study contribute important insights, certain limitations must be acknowledged. The sample size, though adequate for preliminary analysis, may not capture the full variability present in broader populations. Moreover, the subjects were primarily drawn from a specific geographic and ethnic background, which may influence the generalizability of the results. Additionally, factors such as hormonal status, ancestry, and environmental influences were not controlled for, and these could potentially confound the associations being explored.

Future research should aim at expanding sample sizes and including populations with greater ethnic and regional diversity. Advances in molecular genetics could further elucidate the hereditary aspects of these traits, while machine learning algorithms may enhance pattern recognition in forensic databases. Moreover, longitudinal studies assessing the stability of these traits across different age groups could strengthen their applicability in real-world forensic scenarios.

In conclusion, while lip prints and palatal rugae maintain substantial forensic value for individual identification, their role in gender determination appears limited. The canine index stands out as a more dependable marker for sex estimation. The novel finding of a significant

relationship between blood group and rugae pattern warrants further exploration, suggesting a potential genetic link that could be harnessed in future forensic profiling tools. These observations, when integrated with existing forensic methods, can contribute to a more robust and multidimensional approach to personal identification.

Conclusion

CONCLUSION

Cheiloscopy and rugoscopy exhibited unique patterns across individuals, supporting their utility in personal identification, though they showed limited reliability for gender determination. The mandibular canine index demonstrated significant sexual dimorphism, making it a useful and cost-effective tool for identifying gender in forensic contexts. No definitive association was established between lip print or canine index patterns and ABO blood groups, suggesting these traits are likely influenced by independent genetic factors. A mild association between certain palatal rugae patterns and specific blood groups was observed, but the findings were not statistically significant and require further validation. The combined evaluation of cheiloscopy, rugoscopy, and canine index did not yield a consistent pattern strong enough for gender or blood group prediction. Overall, these traits hold value in forensic identification, particularly when traditional methods are unavailable, but their role in determining blood group remains inconclusive. Further large-scale studies with diverse populations are recommended to explore potential genetic or developmental links between these traits and blood group types.

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Annexures

सन्तोष डेन्टल कॉलेज

प्रताप विहार, गाजियाबाद

सहमति पत्र

1. मैं .....पुत्र/पत्री.....निवासी..... ..... अपने ऊपर किये जाने वाले निरीक्षण/ परीक्षण, चिकित्सीय सलाह/पद्धति की पूर्ण सहमति देता/देती हुं।

2. मुझे चिकित्सा प्रणाली और चिकित्सा के उपरान्त होने वाले संभावित नतीजों के बारे में दंत चिकित्सक के द्वारा अच्छी तरह समझाया गया है।

3. मुझे चिकित्सा के दौरान अथवा उसके उपरांत होने वाली संभावित/ अप्रत्याशित हानियों, इलाज के समय उपयुक्त होने वाली दवा व उसके प्रयोग के बारे में भी अच्छी तरह बताया गया है।

4. रोगी के द्वारा चिकित्सा के बीच में ही छोड़कर जाने अथवा चिकित्सा के उपरान्त परिणाम के उम्मीद के अनुसार न आने पर, चिकित्सक की जिम्मेदारी नहीं होगी।

5. मैं पुनः अपनी सहमति देता हूँ कि इस रिकार्ड को भविष्य में चिकित्सीय शोध, प्रशिक्षण एवं चिकित्सा प्रणाली के उत्थान के लिये प्रयोग किया जा सकता है।

तारीखः

रोगी के हस्ताक्षर

Annexure I

DEPARTMENT OF ORAL PATHOLOGY AND MICROBIOLOGY
SANTOSH DENTAL COLLEGE AND HOSPITAL

INFORMED CONSENT

I_____as a legally responsible citizen hereby give my consent for the survey study titled **"AN OBSERVATIONAL CROSS-SECTIONAL STUDY TO ASSESS THE ASSOCIATION OF PATTERNS OF CHELIOSCOPY, RUGOSCOPY AND CANINE INDEX WITH GENDER AND BLOOD GROUPS"** being conducted by **DR. AVNEESH KUMAR**, postgraduate student, under the guidance of **Dr. NEERAJ GROVER,** Professor & Head, Department of Oral Pathology and Microbiology, Santosh Dental College and Hospital Dental Sciences & Research. I have been promised anonymity of the information provided by me. I hereby voluntarily, unconditionally give my consent, without any fear or pressure in mentally sound and conscious state to let myself to participate in this study.

Witness Participant 's Signature

Date:

ANNEXURE II

Group A								
	Canine Width							
Sample No.	Left	Right	Average	Intercanine Distance	Canine Index	Blood Group	Cheiloscopy	Rugoscopy
1	7.860	6.540	7.200	27.090	0.266	A+	V	Wavy
2	7.100	7.160	7.130	26.530	0.269	O-	II	Straight
3	6.920	6.710	6.815	27.560	0.247	B+	IV	Curved
4	6.970	7.780	7.375	30.480	0.242	AB-	I	Circular
5	7.710	7.430	7.570	27.170	0.279	O+	I	Straight
6	7.900	7.400	7.650	28.670	0.267	A-	II	Wavy
7	7.220	6.170	6.695	25.930	0.258	AB+	V	Circular
8	7.520	7.980	7.750	26.170	0.296	B-	I	Curved
9	6.910	6.540	6.725	26.160	0.257	A+	IV	Wavy
10	6.810	7.280	7.045	30.360	0.232	O+	III	Wavy
11	7.390	6.990	7.190	27.570	0.261	B+	I	Curved
12	7.980	7.490	7.735	30.540	0.253	AB-	V	Wavy
13	7.510	7.030	7.270	27.330	0.266	A-	II	Curved
14	7.440	6.470	6.955	30.230	0.230	A-	III	Curved
15	7.990	7.870	7.930	25.730	0.308	B-	IV	Curved
16	7.760	6.020	6.890	27.090	0.254	AB+	V	Wavy
17	7.130	7.830	7.480	29.270	0.256	O+	I	Circular
18	7.350	7.500	7.425	26.510	0.280	A-	III	Straight
19	7.500	7.760	7.630	27.850	0.274	B-	IV	Curved
20	7.810	7.430	7.620	27.680	0.275	AB+	II	Wavy
21	7.230	7.480	7.355	28.330	0.260	O-	V	Straight
22	7.400	6.970	7.185	27.070	0.265	A-	I	Circular
23	7.410	7.870	7.640	28.090	0.272	A-	I	Curved
24	7.060	7.310	7.185	30.210	0.238	O+	III	Wavy
25	6.250	6.330	6.290	27.800	0.226	AB-	II	Curved
26	7.860	7.950	7.905	28.880	0.274	A+	V	Circular
27	7.310	7.110	7.210	28.590	0.252	B-	III	Wavy
28	7.940	7.160	7.550	26.070	0.290	AB+	I	Wavy
29	7.620	6.830	7.225	25.140	0.287	A-	IV	Straight
30	7.160	6.080	6.620	30.340	0.218	A-	II	Circular
31	7.270	6.220	6.745	26.790	0.252	B+	V	Wavy
32	7.520	7.310	7.415	30.690	0.242	AB-	IV	Curved
33	7.730	6.790	7.260	28.540	0.254	O+	I	Straight
34	7.570	6.680	7.125	26.890	0.265	A+	III	Circular
35	7.330	6.080	6.705	28.670	0.234	B-	II	Curved
36	7.730	6.670	7.200	29.970	0.240	AB+	V	Wavy
37	6.900	7.190	7.045	28.820	0.244	A-	II	Circular
38	7.730	6.800	7.265	28.780	0.252	A-	IV	Straight
39	7.530	7.590	7.560	28.200	0.268	B+	I	Curved
40	7.490	6.970	7.230	30.840	0.234	A-	III	Curved
41	7.960	6.680	7.320	25.070	0.292	AB-	V	Circular
42	6.890	7.620	7.255	26.320	0.276	A+	IV	Straight
43	7.240	7.290	7.265	28.190	0.258	A-	III	Wavy
44	7.670	7.540	7.605	26.300	0.289	AB+	II	Wavy
45	7.360	7.620	7.490	26.750	0.280	O-	I	Circular
46	7.110	6.180	6.645	25.180	0.264	A-	V	Straight
47	7.690	7.360	7.525	29.930	0.251	B+	I	Wavy
48	7.680	7.700	7.690	30.340	0.253	O+	II	Curved
49	6.990	7.130	7.060	36.000	0.196	AB-	IV	Circular
50	6.930	6.870	6.900	26.170	0.264	A+	I	Wavy
51	7.170	7.800	7.485	26.410	0.283	B-	V	Straight
52	7.320	7.780	7.550	27.720	0.272	AB+	IV	Curved
53	7.190	6.310	6.750	27.000	0.250	O-	III	Circular
54	6.970	7.660	7.315	27.390	0.267	A-	II	Straight
55	6.950	6.550	6.750	29.570	0.228	B+	I	Wavy
56	7.120	7.320	7.220	28.060	0.257	A-	V	Curved
57	6.800	6.640	6.720	29.660	0.227	AB-	II	Circular
58	6.920	7.820	7.370	26.750	0.276	A+	III	Curved
59	7.780	7.160	7.470	26.280	0.284	B-	IV	Curved
60	7.600	6.390	6.995	27.770	0.252	AB+	I	Wavy
61	7.590	7.950	7.770	30.360	0.256	O-	V	Curved
62	7.750	6.320	7.035	27.120	0.259	A-	II	Straight
63	7.030	6.370	6.700	25.980	0.258	B+	IV	Curved
64	6.920	6.900	6.910	27.650	0.250	O+	III	Wavy

65	7.760	6.620	7.190	25.970	0.277	AB-	I	Circular
66	7.050	7.010	7.030	30.900	0.228	A+	V	Straight
67	7.750	7.500	7.625	25.240	0.302	B-	III	Curved
68	7.860	7.910	7.885	27.740	0.284	AB+	II	Wavy
69	7.510	7.460	7.485	27.100	0.276	O-	IV	Circular
70	7.870	6.070	6.970	28.270	0.247	A-	I	Wavy
71	7.920	7.700	7.810	25.170	0.310	B+	I	Straight
72	7.140	7.590	7.365	29.170	0.252	O+	IV	Curved
73	7.840	6.600	7.220	29.940	0.241	AB-	II	Circular
74	7.850	7.480	7.665	27.420	0.280	A+	III	Straight
75	7.800	6.640	7.220	26.680	0.271	B-	I	Wavy
76	6.840	6.250	6.545	27.930	0.234	AB+	V	Curved
77	7.830	7.090	7.460	29.520	0.253	O-	III	Circular
78	7.460	6.190	6.825	28.430	0.240	A-	IV	Curved
79	7.580	6.390	6.985	27.420	0.255	A-	II	Curved
80	7.070	7.550	7.310	29.740	0.246	O+	II	Wavy
81	7.450	7.500	7.475	29.080	0.257	AB-	I	Circular
82	7.290	6.280	6.785	26.760	0.254	A+	II	Straight
83	7.770	7.110	7.440	25.590	0.291	B-	IV	Curved
84	6.810	6.680	6.745	29.130	0.232	AB+	III	Wavy
85	6.980	6.020	6.500	28.030	0.232	O-	I	Circular
86	7.280	7.730	7.505	29.460	0.255	A-	I	Straight
87	6.920	6.370	6.645	28.020	0.237	B+	II	Curved
88	7.410	6.700	7.055	25.230	0.280	O+	II	Wavy
89	7.800	7.900	7.850	25.910	0.303	AB-	III	Circular
90	7.700	6.050	6.875	26.060	0.264	A+	I	Straight
91	7.440	7.420	7.430	27.030	0.275	B-	V	Curved
92	6.830	7.140	6.985	30.610	0.228	AB+	III	Wavy
93	7.900	6.130	7.015	25.340	0.277	O-	IV	Curved
94	7.980	6.650	7.315	30.980	0.236	A-	II	Wavy
95	7.090	7.680	7.385	29.490	0.250	B+	I	Straight
96	6.920	6.740	6.830	28.030	0.244	A-	V	Curved
97	7.140	7.460	7.300	27.470	0.266	AB-	IV	Circular
98	7.610	6.540	7.075	29.420	0.240	A+	II	Straight
99	7.670	7.000	7.335	26.860	0.273	B-	III	Curved
100	7.280	7.470	7.375	29.620	0.249	AB+	I	Wavy
101	7.690	6.700	7.195	29.940	0.240	O-	V	Circular
102	7.750	7.510	7.630	25.180	0.303	A-	III	Straight
103	7.740	6.210	6.975	30.890	0.226	B+	IV	Wavy
104	7.590	7.080	7.335	26.410	0.278	O+	II	Wavy
105	6.820	7.610	7.215	27.390	0.263	AB-	I	Wavy
106	7.430	7.460	7.445	25.070	0.297	A+	V	Curved
107	6.960	7.020	6.990	25.230	0.277	B-	II	Curved
108	7.470	7.440	7.455	25.870	0.288	A-	IV	Wavy
109	7.500	6.350	6.925	26.370	0.263	O-	II	Curved
110	7.200	6.670	6.935	29.990	0.231	A-	I	Curved

ANNEXURE II

Group B								
	Canine Width							
Sample No.	Left	Right	Average	Intercanine Distance	Canine Index	Blood Group	Cheiloscopy	Rugoscopy
1	6.480	6.960	6.720	26.940	0.249	O-	I	Circular
2	5.980	6.570	6.275	26.430	0.237	A+	V	Wavy
3	6.460	5.570	6.015	28.640	0.210	B-	II	Straight
4	6.590	7.640	7.115	23.120	0.308	AB+	IV	Curved
5	6.370	7.240	6.805	23.640	0.288	O+	III	Wavy
6	5.820	6.030	5.925	27.480	0.216	A-	I	Wavy
7	5.910	7.040	6.475	27.430	0.236	B+	V	Straight
8	6.160	6.850	6.505	22.040	0.295	AB-	IV	Curved
9	6.780	5.640	6.210	27.830	0.223	B-	II	Wavy
10	6.760	6.460	6.610	28.380	0.233	O+	III	Circular
11	7.230	5.820	6.525	25.850	0.252	A+	I	Circular
12	6.100	6.100	6.100	23.220	0.263	AB+	II	Curved
13	6.090	6.890	6.490	22.260	0.292	O-	V	Wavy
14	6.480	7.230	6.855	26.180	0.262	B+	I	Wavy
15	7.250	7.000	7.125	23.600	0.302	A-	IV	Straight
16	6.680	5.640	6.160	24.210	0.254	AB-	III	Wavy
17	6.140	6.070	6.105	29.390	0.208	B+	V	Curved
18	6.790	7.470	7.130	27.240	0.262	O-	II	Wavy
19	6.600	6.460	6.530	28.050	0.233	A+	IV	Curved
20	6.100	8.000	7.050	28.140	0.251	AB+	I	Circular
21	6.070	6.680	6.375	29.200	0.218	O+	I	Curved
22	6.540	7.720	7.130	24.050	0.296	B-	III	Straight
23	5.860	6.220	6.040	26.750	0.226	A-	II	Curved
24	7.470	5.590	6.530	27.300	0.239	AB-	V	Wavy
25	7.360	6.020	6.690	23.070	0.290	O-	III	Curved
26	6.460	5.660	6.060	25.170	0.241	B+	I	Circular
27	6.660	6.100	6.380	25.400	0.251	A+	IV	Straight
28	5.930	6.990	6.460	25.890	0.250	AB+	II	Wavy
29	5.650	7.530	6.590	24.570	0.268	B-	V	Curved
30	6.420	5.830	6.125	28.630	0.214	O+	IV	Wavy
31	5.590	5.760	5.675	27.700	0.205	A-	I	Curved
32	6.760	7.470	7.115	24.020	0.296	AB-	III	Straight
33	6.620	6.640	6.630	29.140	0.228	O+	II	Wavy
34	6.710	6.850	6.780	24.480	0.277	B-	V	Curved
35	6.340	5.870	6.105	27.070	0.226	A+	II	Circular
36	6.840	6.800	6.820	29.210	0.233	AB+	IV	Wavy
37	7.490	6.700	7.095	22.710	0.312	O-	I	Circular
38	5.680	5.910	5.795	29.040	0.200	B+	III	Curved
39	7.270	6.440	6.855	22.860	0.300	A-	V	Curved
40	6.340	5.630	5.985	25.080	0.239	AB-	IV	Wavy
41	5.980	6.570	6.275	25.600	0.245	B-	III	Straight
42	6.170	7.070	6.620	28.050	0.236	O+	II	Circular
43	5.830	7.000	6.415	23.510	0.273	A+	I	Curved
44	6.650	6.130	6.390	25.600	0.250	AB+	V	Wavy
45	5.580	7.170	6.375	25.000	0.255	O+	I	Straight
46	6.440	6.100	6.270	22.970	0.273	B+	II	Curved
47	6.490	5.560	6.025	27.190	0.222	A-	II	Circular
48	5.980	5.830	5.905	26.840	0.220	AB-	I	Wavy
49	5.530	7.470	6.500	29.400	0.221	O-	V	Straight
50	5.830	6.390	6.110	25.920	0.236	B-	IV	Curved
51	5.990	7.440	6.715	29.800	0.225	A+	III	Curved
52	5.790	5.820	5.805	27.900	0.208	AB+	II	Wavy
53	6.200	6.120	6.160	27.090	0.227	B+	I	Circular
54	7.020	6.980	7.000	27.910	0.251	O-	V	Curved
55	7.220	7.120	7.170	24.990	0.287	A-	II	Straight
56	6.080	6.640	6.360	22.410	0.284	AB-	III	Circular
57	6.540	6.680	6.610	23.980	0.276	O+	II	Straight
58	7.260	6.880	7.070	25.200	0.281	B-	I	Curved
59	6.850	6.570	6.710	32.000	0.210	A+	V	Wavy
60	6.240	7.690	6.965	27.760	0.251	AB+	II	Curved
61	6.210	6.950	6.580	29.590	0.222	O-	II	Wavy
62	6.500	6.000	6.250	25.150	0.249	B+	III	Curved
63	7.410	6.400	6.905	24.860	0.278	A-	I	Straight
64	5.590	6.920	6.255	25.390	0.246	AB-	V	Circular

65	6.010	7.480	6.745	28.180	0.239	B-	III	Wavy
66	6.610	7.390	7.000	28.790	0.243	O+	II	Circular
67	6.640	7.540	7.090	29.930	0.237	A+	IV	Curved
68	5.520	6.480	6.000	22.650	0.265	AB+	I	Curved
69	5.880	5.780	5.830	26.560	0.220	O-	I	Wavy
70	5.800	6.550	6.175	23.680	0.261	B+	IV	Straight
71	6.330	6.450	6.390	29.140	0.219	A-	II	Circular
72	6.020	7.660	6.840	28.150	0.243	AB-	II	Wavy
73	6.360	5.660	6.010	25.060	0.240	O+	I	Straight
74	5.860	5.620	5.740	25.200	0.228	B-	V	Curved
75	7.090	7.100	7.095	29.330	0.242	A+	III	Wavy
76	7.190	5.980	6.585	24.950	0.264	AB+	IV	Wavy
77	5.540	7.740	6.640	24.780	0.268	B+	II	Curved
78	7.120	5.550	6.335	23.570	0.269	O-	II	Circular
79	5.870	6.820	6.345	23.950	0.265	A-	I	Curved
80	6.170	6.410	6.290	24.380	0.258	AB-	II	Straight
81	7.460	6.660	7.060	23.880	0.296	O+	IV	Circular
82	6.710	6.940	6.825	29.420	0.232	B-	III	Wavy
83	5.740	5.700	5.720	24.250	0.236	A+	I	Straight
84	6.860	6.550	6.705	23.210	0.289	AB+	I	Curved
85	7.160	5.560	6.360	29.400	0.216	O-	II	Curved
86	6.920	7.330	7.125	28.760	0.248	B+	II	Curved
87	5.620	6.560	6.090	22.110	0.275	A-	III	Wavy
88	7.440	7.520	7.480	28.410	0.263	AB-	I	Wavy
89	7.060	6.030	6.545	25.800	0.254	B-	V	Curved
90	6.580	6.220	6.400	24.370	0.263	O+	III	Straight
91	6.160	6.060	6.110	25.420	0.240	A+	II	Circular
92	6.970	5.810	6.390	25.080	0.255	AB+	II	Curved
93	6.700	7.170	6.935	25.180	0.275	O+	I	Straight
94	8.000	6.500	7.250	24.510	0.296	B+	V	Curved
95	6.430	6.340	6.385	26.910	0.237	A-	IV	Straight
96	6.780	7.530	7.155	28.780	0.249	AB-	II	Circular
97	7.160	5.840	6.500	28.650	0.227	O-	III	Wavy
98	7.040	7.400	7.220	25.850	0.279	B-	I	Wavy
99	7.220	6.720	6.970	26.310	0.265	A+	V	Circular
100	5.700	6.930	6.315	27.500	0.230	AB+	II	Wavy
101	6.540	6.890	6.715	26.820	0.250	B+	II	Circular
102	6.340	6.460	6.400	26.900	0.238	O-	II	Circular
103	6.860	5.590	6.225	27.490	0.226	A-	I	Circular
104	6.610	7.790	7.200	29.070	0.248	AB-	V	Wavy
105	6.850	6.430	6.640	24.570	0.270	O+	II	Straight
106	6.570	7.460	7.015	24.410	0.287	B-	IV	Wavy
107	6.480	6.540	6.510	28.020	0.232	A+	II	Wavy
108	7.360	6.800	7.080	28.400	0.249	AB+	I	Wavy
109	7.260	7.530	7.395	22.250	0.332	O-	II	Straight
110	6.880	6.390	6.635	24.250	0.274	B+	II	Wavy

Dr Avneesh Kumar

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Subject: Grant of Ethical Clearance for Thesis Protocol Topic "An observational cross-sectional study to assess the association of patterns of chelioscopy, rugoscopy and canine index with gender and blood groups", submitted by **Dr. AVNEESH KUMAR,** MDS student of Batch 2022-2023, Department of **ORAL PATHOLOGY & MICROBIOLOGY**.

*****

With reference to his/her request for grant of Ethical Clearance for the Thesis Protocol entitled "An observational cross-sectional study to assess the association of patterns of chelioscopy, rugoscopy and canine index with gender and blood groups", **Dr. AVNEESH KUMAR** is informed that the Thesis Protocol submitted by him/her was considered by the **Screening Committee** of the Santosh Dental College & Hospital in its meetings held on 07.02.2023 & 08.02.2023. The recommendations of the **Screening Committee** were considered in detail by the Institutional **Ethics Committee** in its meeting held on **23.09.2023** and the same was **approved** by the **Ethics Committee**.

He /She is informed accordingly for further necessary action.

[DR. NARESH SHARMA]
REGISTRAR

SANTOSH "DEEMED TO BE UNIVERSITY" REGISTRAR GHAZIABAD, NCR DELHI

Dr. AVNEESH KUMAR
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